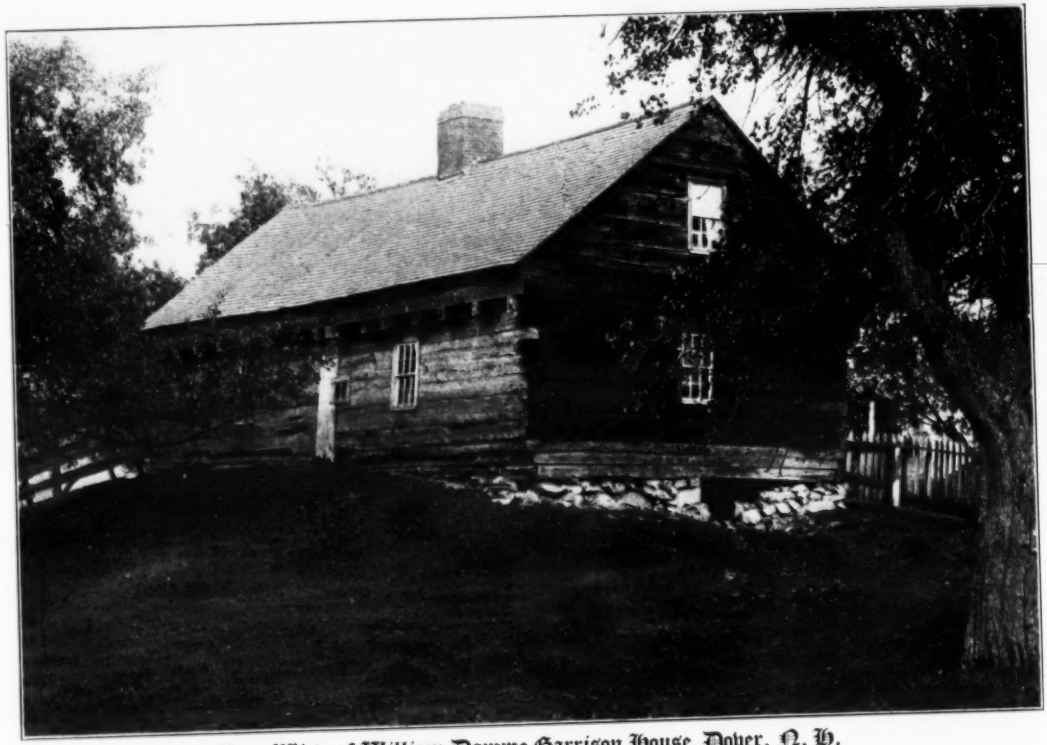

Rear View of William Damme Garrison House, Dover, N. H.

BUILT BEFORE 1698 AND NOW PRESERVED ON THE GROUNDS OF THE WOODMAN INSTITUTE, DOVER

Old-Time New England

THE BULLETIN OF

The Society for the Preservation of New England Antiquities

A QUARTERLY MAGAZINE
DEVOTED TO THE ANCIENT BUILDINGS, HOUSEHOLD FURNISHINGS, DOMESTIC ARTS MANNERS AND CUSTOMS, AND MINOR ANTIQUITIES OF THE NEW ENGLAND PEOPLE

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The Garrisons of Ancient Dover, N. H.

By Louis W. Flanders, M.D.

TWO or three generations ago the attentive observer might have seen scattered about through New England, certain isolated houses of peculiar form and construction. They were usually two stories high, the upper story projecting over the lower to the extent of two feet or more. This unusual formation gave one the impression that the house was sitting up in the air, resting upon a foundation too small for it; but, as will appear later, this overhanging upper story was necessary to fulfill the purpose for which the house was built. These top-heavy structures were the garrison houses into which our fathers fled for defence against the Indians.

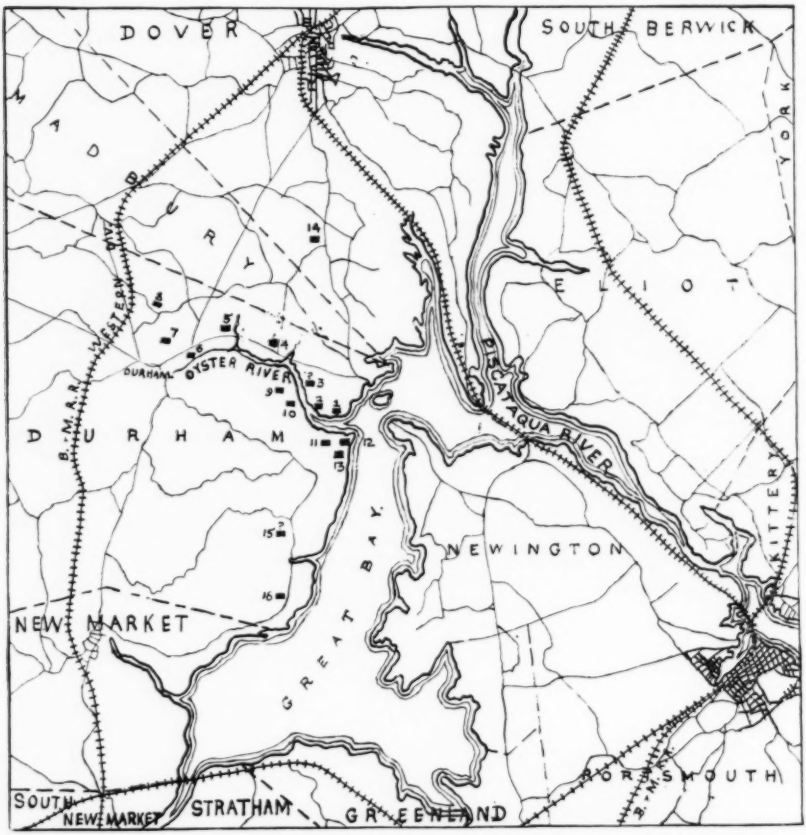
They were built of squared logs, interlocked at the corners and securely pinned. Each of the four sides was pierced with loop-holes, either in the form of horizontal slits or in the shape of truncated pyramids, the bases opening into the house and ending outside in a square hole a little larger than the diameter of a gun-barrel. This construction was necessary in order that the guns might be turned in any direction requisite to sweep the field in front.

The houses were sometimes surrounded with palisades made of logs set upright and close together in the earth. Some idea of these defences may be gained from the records of Dover. Under the minutes of 1667 we read:

"The selectmen agreed with Left. Coffin to build the fort about the meetinghouse on Dover Neck, one hundred foot square, with two sconces of sixteen foot square, and all the timber to be twelve inches thick and the wall to be eight foot high with sills and braces."

The "sconces," sometimes called "flankarts," were watch towers from which, in the time of an Indian uprising, a sentinel gave timely notice of the approach of the enemy.

Garrison houses were almost invariably built upon a high knoll, rarely in the midst of an open plain. This gave an uninterrupted view making it very difficult for the enemy to approach unseen. If the palisades were carried by assault, there was still the blockhouse into which to retreat. Here the necessity for the overhanging upper story becomes apparent. It was the custom of the Indians to try to dislodge the



Map showing location of Garrison Houses in the settlements at Dover, N. H.

1 MEADER, 2. DAVIS, 3. SMITH, 4. BUNKER, 5. JONES, 6. BEARD, 7. WOODMAN, 8. HUCKINS, 9. BURNHAM, 10. DAMME, 11. ADAMS, 12. BICKFORD, 13. EDGERLY, 14. MESERVE, 15. EDGERLY, 16. SMITH.

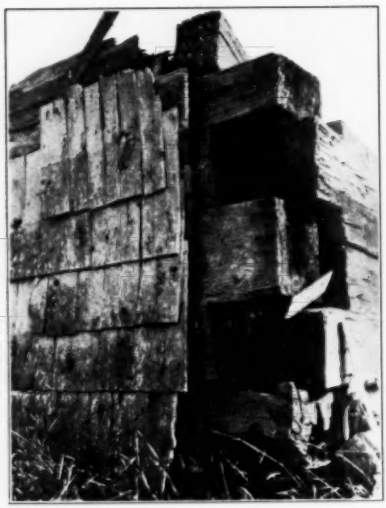
settlers from this stronghold by means of fire and smoke. A loose board in the overhang of the chamber above could be raised, and from this place water was poured down upon the fires below. Tradition has it that the women were stationed up there with kettles of boiling water which they doused down upon the heads of the unwary.

Not every dwelling house was fortified. We have seen that a fort was built about the old meeting house on Dover Neck, and that was the garrison house for that neighborhood. There were some twelve or fifteen garrisons in the Oyster River settlement. Into these the people fled for safety during an Indian attack and in troublous

Woodman Garrison House, Durham, N. H.

FROM A PHOTOGRAPH MADE ABOUT 1895

The Burning of the Woodman Garrison House, Durham, N. H., Nov. 8, 1896



Dovetailed logs at the corner of the Bunker Garrison House Durham, N. H.

FROM A PHOTOGRAPH MADE IN 1911

Port Hole on the west side of the Bunker Garrison House Durham, N. H.

FROM A PHOTOGRAPH MADE IN 1911

times they repaired to them nightly.

A map of ancient Dover covering the towns of Dover, Rollinsford, Somersworth, Durham, Lee, Newmarket and a part of Newington and Greenland, shows the sites of fifty garrisons within a radius of fifteen miles of the city of today. Most of them were built after 1665. It will be remembered that Massachusetts gave the Pequots a fearful drubbing in 1637. That so fierce and warlike a tribe could be so thoroughly beaten by a handful of whites made a deep impression upon the Indians, and they kept the peace after that for over forty years. There were, of course, sporadic murderings and scalpings during that time, but there was no general uprising until the war with King Philip, in 1675.

The record of the next fifty years is one of burning, pillaging and massacre. The nightly refuge was always the blockhouse, and men hoed the fields the rifle close at hand. Men, women and even children took part in the defence. In one instance we read of a man who, with his daughter of twelve, defended their garrison stoutly until overwhelmed with numbers. The girl was promptly killed and scalped upon the evidence of her little hands which were stained and blackened with gunpowder.

In 1895, of all the garrisons of ancient Dover, only four were standing: the Woodman in Durham, which had been made over to such an extent that the overhanging upper story on one side was the only suggestion of a garrison house left about it; the Bunker garrison, also in Durham; the William Damme or Drew garrison in Dover and the ruins of the Meserve garrison on the Gerrish-Drew farm in the Back River district of Dover. The upper story of the Bunker garrison

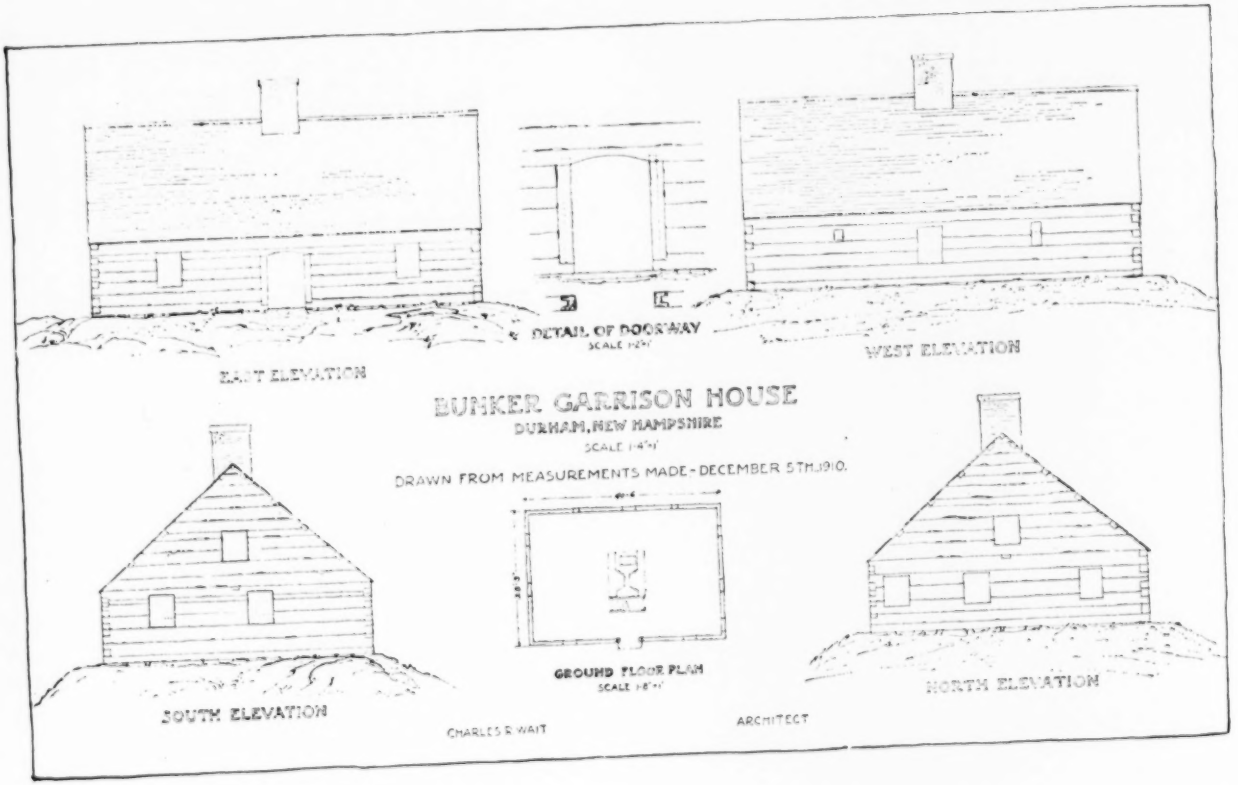
Bunker Garrison House, Durham, N. H.

FROM A PHOTOGRAPH MADE ABOUT 1895

was removed about 1875. The lower story had been clapboarded, but the boards had fallen away so that the logs underneath could be plainly seen. The Meserve garrison showed a construction occasionally met with in garrisons built after the year 1700. In this case the building was lathed and plastered and bricks set up edgewise in the partitions to make the structure bullet-proof. A picture of this garrison was hanging in the Drew farmhouse kitchen in 1895. A copy of it is presented with this paper. The William Damme or Drew garrison has been removed from the original site and set up again in the grounds of the Woodman Institute in the city of Dover.

Considering the historic value of these houses one cannot but feel regret at the indifference shown in their preservation. Sometimes, indeed, if the timbers were sound, they were clapboarded outside, lathed and plastered inside and converted into modern dwelling houses. This was the case with the Woodman garrison at Durham. Too often, however, they were allowed to decay. As long as they would stand, they were used for tool houses and even hen houses. In some cases they were taken down as in the story of the Smith garrison in Lubberland. Somebody was building a barn; here were some splendid timbers already fitted; there were no more Indians; so the bones of the old hero were pulled apart and used to frame a barn.

The Woodman garrison was burned to the ground, November 8, 1896. The logs were plainly visible at the burning and the old windows, which were


EAST ELEVATION
DETAIL OF DOORWAY
SCALE 1"=1'
WEST ELEVATION
BUNKER GARRISON HOUSE
DURHAM, NEW HAMPSHIRE
SCALE 1/4"=1'
DRAWN FROM MEASUREMENTS MADE - DECEMBER 5TH 1910.
GROUND FLOOR PLAN
SCALE 1/8"=1'
SOUTH ELEVATION
NORTH ELEVATION
CHARLES R WAIT
ARCHITECT

Front View of William Damme Garrison House Dover, N. H.

FROM A PHOTOGRAPH MADE ABOUT 1895

horizontal slits, could be seen outlined against the new in the form of a Greek cross. Many people secured pieces of logs with bullets imbedded in them. These bullets were never imbedded deeply; never deeper than two inches. Powder was scarce and expensive; that meant that it was used sparingly. Again, the Indians had a wholesome respect for the marksmanship of the whites; they therefore fired from a prudent distance. That they sometimes misjudged distances is evident from the record of the Indian who appeared before Burnham's garrison at Oyster River, making "indecent signs of defiance." An exasperated youth fired from the flankart of the garrison and hit him in the heel. That ended the sign language and the offender was carried off on a horse.

Those garrisons of ancient Dover which were subjected to Indian attack seem to be most interesting historically. There were two raids of consequence upon the settlers of Dover: that upon the Cochecho settlement — now the city of Dover — in June 1689; and the descent upon the Oyster River settlement in Durham, in July 1694. After the war with King Philip, many of his adherents fled to New Hampshire to escape the vengeance of Massachusetts. In 1677, Massachusetts sent soldiers into New Hampshire to apprehend these "strange Indians," as they were called. About four hundred of them were found at Cochecho and taken by a strategy that cannot be commended by lovers of fair play. Of these, two hundred, who were known to have had some part in the war, were sent to Massachusetts. Some of them were executed and the rest were deported

into slavery. Dover had to bear the full brunt of vengeance for this deed. After thirteen years, Hagkins, one of the deported Sagamores, returned from captivity thirsting for blood. Gathering about him as many sympathizers as possible, he planned to get even with Major Waldron.

Cochecho, like Rome, seems to have been built upon seven hills and every hill was topped by a garrison house. In 1689 there were five in the compact part of the town. On the north side of Cochecho Falls were Waldron's, Otis's and Heard's. On the south side were Peter Coffin's garrison and that of his son Tristram. These were all fortified houses, palisaded and maintained more or less at public expense for the safety of the people. The Indians planned to send two squaws to each garrison who were to ask for shelter for the night. At a given signal they were to open the gates of the palisades and admit the enemy.

It does not seem possible that such a flimsy plan could succeed, but it did. Major Waldron seems to have been strangely indifferent. When his neighbors complained that there were too many Indians in town, he laughed at them. A tradition that was in print a century ago, records that one of the squaws at Waldron's garrison, stricken with remorse at the kindness of her reception, endeavored to warn the old man. Pretending to be sick she rolled about the floor groaning and chanting,

> "Oh Major Waldo
> You great Sagamore,
> What will you do?
> Injuns at the door."

No attention was paid to her. The gates were opened and the massacre took place.

Somewhere beneath the foundations of Dover are the sites of those old garrisons. Nobody certainly knows where. Sometimes in excavating for new buildings, the workmen turn up a rusty door latch, a brick of ancient make, or, as in one case recently a human skeleton; but nobody can say surely where the houses stood in which our fathers fought and suffered.

There seems to have been the same heedlessness in the Oyster River raid. It was openly talked of in Quebec weeks before it happened, and yet the event found the settlers without powder, poorly prepared and inefficient. One sometimes wonders at the fierceness of the bloodlust that compelled men to travel two or three hundred miles through a trackless wilderness just to massacre a few people at Oyster River. But when we reflect upon the fact that men will travel greater distances to shoot a few deer in Maine, we begin to understand it. In 1694, a little patch of hide from the top of a man's head had a far greater value than many deer skins. A captive delivered in Canada brought a high price. He was sold into servitude or held for ransom. The records show that it was not an uncommon thing for the settlers in New England to "pass the hat" in order to obtain funds to redeem one of their number from captivity.

In 1694 there were ten garrison-houses on the banks of the Oyster River below the bridge or falls in Durham. On the north side, beginning at the falls, were Beard's, Jones's, Bunker's, Smith's, Davis's and Medar's. On the south side, in the same order, were Burnham's, Drew's, Adams' and Bickford's. In addition to these, there were Edgerly's garrison, situated further

Ruins of the chimney of the Meserve Garrison House, Dover, N. H.

FROM A PHOTOGRAPH MADE IN 1910

Ruins of the Meserve Garrison House, Dover, N. H.

FROM A PHOTOGRAPH MADE ABOUT 1895

Smith Garrison House, Lubberland, Dover, N. H.

FROM A STEREOSCOPIC VIEW MADE ABOUT 1875

south near the shore of Little Bay, and Woodman's garrison which stood on the slope of a hill about half a mile from the falls. Huckin's garrison, the nearest neighbor to the Woodman, had been burned about five years before, a few weeks after the massacre at Cochecho. In the raid under the direction of Villieu, five of these houses were destroyed.

Thirty years ago the writer made a careful search along the shores of Oyster River for the sites of these strongholds. It was impossible to find any trace of them. The big mound, covering the bodies of fourteen people slain at Adams' garrison, was still visible. Near the knoll, the probable site of the Davis garrison, among a collection of graves was a slate stone nearly sunken out of sight. After digging the turf away, the following inscription came into view:

"Colonel James Davis Esqr., departed this life in the 88th year of his age, Sept. the 5th, 1751."

Here, then, one would think was the last resting-place of that doughty old Indian fighter, who, upon the night of the massacre, sent his family down the river in a boat and successfully defended his house with the help of his brother. In speaking of the site of this garrison Miss Thompson writes:

"From this knoll, now so solitary and peaceful, Colonel Davis could, on that night of horrors in 1694, not only hear the cries of the savages and their victims, but could plainly see the flames consuming the Meader garrison below and Beard's garrison above and, across the river, the Adams and Drew garrisons. . . ."

The photograph with the big pine stump in the foreground was taken from that knoll.

View of Oyster River, from the site of the Col. James Davis Garrison House, Dover, N. H.

FROM A PHOTOGRAPH MADE ABOUT 1895

In like manner, thirty years ago, near the site of the Smith garrison, was a slate stone with this record:

"Sacred to the memory of Joseph Smith who died Dec. 15, 1728, aged 84. He was the first European who cultivated the soil in which his remains are deposited."

So, then, of all the garrisons of ancient Dover, but one remains to us, the William Damme garrison on the grounds of the Woodman Institute. It will well repay anyone who visits it. Let us dwell upon the lesson it teaches, and if any reader of this paper thinks his lot in this life is hard, let him remember the Dover mother who stood in the door of her garrison house and saw the Indians take her two little daughters, five and seven years old, and deliberately chop their heads off on a log as one would decapitate a chicken. Not satisfied with this, they carried the heads off with them that they might scalp them at their leisure, and afterwards they threw the ghastly remains into the bushes where they were found later by the heartbroken father.

NOTES:

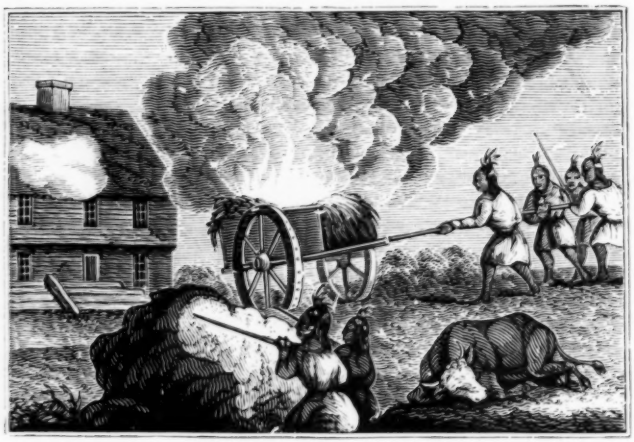
"The large Burnham house, now deserted, that stands on a ridge at the lower side of Gibbon's meadow, is also said to have been a garrison . . . one end is lined with a brick wall, originally pierced with loop-holes."— THOMPSON, *Landmarks of Ancient Dover*, 1892.

The Varney garrison "is a large garrison of two stories, the second story projecting three feet over the first." — *Dover Records*.

"The Bunker garrison had a second story which was taken down about 1875." — *Recollections of Dr. John R. Ham*.

"Of the twelve garrisoned houses, five were destroyed, viz.: Adams', Drew's, Edgerly's, Medar's and Beard's. They entered Adams' without resistance, where they killed fourteen persons; one of them, being a woman with child, they ripped open. The grave is still to be seen in which they were all buried. . . . The defenceless houses were nearly all set on fire, the inhabitants being either killed or taken in them, or else in endeavoring to fly to the garrisons. . . .

The other seven garrisons, viz.: Burnham's, Bickford's, Smith's, Bunker's, Davis's, Jones's and Woodman's were resolutely and successfully defended. At Burnham's the gate [of the palisade] was left open. A man within, who had been kept awake by the toothache, hearing the first gun, roused the people and secured the gate just as the Indians were entering. . . . Captain Jones, hearing his dogs bark, and imagining wolves might be near, went out to secure some swine and returned unmolested. He then went up into the flankard and sat on the wall. Discerning the flash of a gun, he dropped backward; the ball entered the place from whence he had withdrawn his legs. . . . The Indians finally withdrew having killed and captivated between ninety and one hundred persons, and burned about twenty houses, of which five were garrisons." — Belknap's *History of New-Hampshire*, Volume I, pp. 268–277.



Indians attacking a Garrison House

FROM AN OLD WOOD ENGRAVING

Ancient Carpenters' Tools, Part VI

By Henry C. Mercer, D.Sc.

Tools for Shaping and Fitting

UP TO this point, the tools of the carpenter, however indispensable, may be looked upon as preparatory to his final work, namely, the perfected adjustment of pieces of wood. Hence, all the instruments which form to a desired size the previously prepared wooden material for that final purpose, whether by cutting it into shape and over- or underlapping it with or without a framework, or fastening it together with the help of mortise, tenon, dovetail, mitre, nails, bolts, pegs, glue, etc., may be regarded as the final master tools of the woodworker, among which, for fear of confusion, though at the risk of describing some instruments out of place, we venture to distinguish in a series, *Tools for Shaping and Fitting*, beginning with one of the most conspicuous and important of them all, namely

The Open Hand Saw (Fig. 129)

a wide, *c.* 2 ft. by 10 in. smooth-ground steel blade, with triangular-shaped, pointed teeth notched at a slant (raked), away from the hand, so as to cut chiefly on the push of the workman.

The picture shows three of these open saws of Anglo-American type, and probably of English factory make, imported into the United States before 1830 to 1840. All are decorated on their upper blade margins with the minute ornamental knobs, not shown by Moxon but appearing in pictures of the 18th century, still used to adorn saw blades. The upper, a rare tool, found in a gravedigger's shed at the old (1763) Buckingham Friends Meeting House, near Doylestown, Pa., shows the earliest type of this wide-bladed, unframed Anglo-American carpenter's hand saw, as described and illustrated by Moxon. In construction it resembles the carpenter's hand saw of today, except in the shape and set of its handle, which lacks the now invariable hollow grasp and is not riveted upon the blade, through a slot, but set on a tang. This hollow grasp, which Moxon does not show, and the earliest example of which, found by the writer, appears in Hogarth's engraving of "Gin Lane," dated 1756, appears upon the two lower saws, mounted with homemade handles by American carpenters before the establishment of American saw factories, *c.* 1840, while the greater antiquity of the upper saw, the teeth of which are very roughly filed and now show no "set," is proved, not only by this now utterly forgotten tanged handle and open grasp, but also by the following old Dutch copper engraving of 1718,

The Carpenter's Open Hand Saw of the 17th Century (Fig. 130)

where the same saw is clearly represented lying on the ground. It also appears carried under the arm of a house building carpenter, in a little pictured title page of the rare *Exact Dealer Refined*, 5th edition, enlarged, by J. H. Rhodes, London, 1702.

In no other resting place except the secluded and rarely visited out house of the dead, where this relic was found, can we reasonably suppose that such a

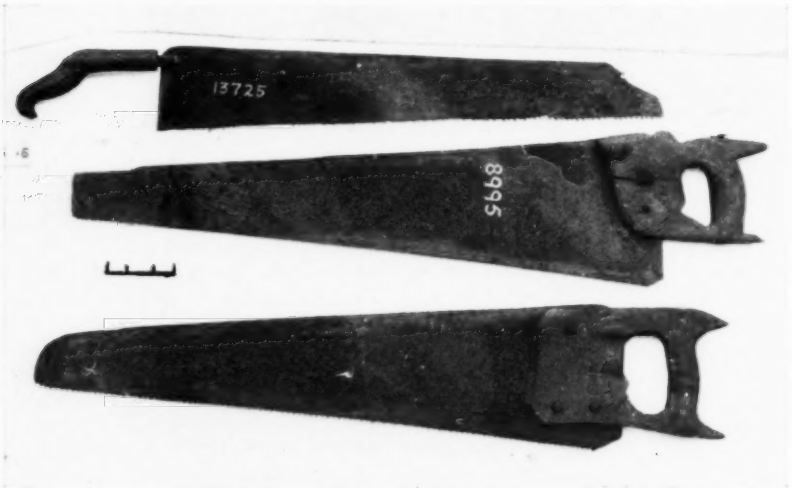


Fig. 129.—The Open Hand Saw

The two lower specimens are old Bucks Co., Pa., carpenter's relics. Their factory-made blades are riveted in a slot upon homemade handles, which latter show the now universal hollow grasp, not appearing on Anglo-American saws before about 1750. The very rare upper specimen, found in a grave digger's shed at the Buckingham Friends Meeting House, Bucks Co., Pa., and doubtless used for cutting off tree roots in freshly dug graves, is of date probably before 1768, and shows the earlier type of open handle, mounted on a tang, as used in Holland, England, and the American Colonies in the 17th and 18th centuries. The rudely filed, irregular teeth of this saw have lost their set, and a down-cut with ornamental knob, partly rusted away, decorates the end of the blade on its top corner margin, which trivial and curious silhouette noted by Disston, without explanation of its origin, in *The Saw in History* (Henry Disston & Sons, Philadelphia, 1916), and now appearing on many American open hand saws, appears clearly on the two lower specimens.

saw would so long have escaped the innumerable chances which elsewhere would have destroyed or lost it. One hundred and eighty years ago, or about 1740, when the original meeting house was built, we may reasonably suppose that the first gravedigger used the tool to saw off grave-obstructing tree roots in the freshly cleared graveyard, which is still surrounded by woods. But the once omnipresent roots have long since rotted away; generations have come and gone since the old meeting house burnt down, in 1768, to be then replaced by the present building, while the saw, never lost, broken, worn out, or rusted away, remains.

A small variety of the one-man, open hand saw is shown in two of its smaller forms in the next illustration as

The Compass and Keyhole Saw (Fig. 131)

with teeth unset, as Moxon says, and with blades extra thick for strength, but extra narrow, and thin at the back, to avoid friction in cutting short circular kerfs, as for key or latch or lock holes in doors.

The blade of the old homemade, upper specimen, as with modern factory-made types, used for fine keyhole work, is riveted in a slot on a straight handle, not mounted on a tang like the

Fig. 130.—The Carpenter's Open Hand Saw of the 17th Century

The picture called *De Timmerman* (The Carpenter), is one of a hundred copper engravings, representing workmen at their trades, from "*Spiegel Van Het Menselyk Bedryf*, Van Kornelis Van Der Lys and J & K Luyken, Amsterdam, 1718." The hand saw lying on the ground with its broad blade decorated with the still surviving ornamental knob at the upper end margin, and tanged, not riveted, to the handle, and with its small, down-curved open hand grasp, is almost an exact duplicate of the ancient hand saw found in 1920, by Mr. R. P. Hommel, in the grave digger's shed at the old Quaker Meeting House at Buckingham, Bucks Co., Pa., shown in Fig. 129.

Fig. 131.—The Keyhole and Compass Saw

The very narrow-bladed keyhole saw is here shown in the upper specimen, No. 2568, and illustrated by Moxon in 1678. Its old-style handle, not formed to the hand, and riveted on the blade, is straight like the handle of a chisel. The teeth, in this case, five to the inch, unlike those of other saws, are not set at all, and the blade, tapering from one to one-quarter of an inch, thins towards the top or back, so as to run easily in a wide kerf, when the instrument, following a more or less curved line, cuts around a corner, and where, but for the frame, which is always in the way, the much thinner strained blade of the Buhl saw (Fig. 144) would do the work better. The instrument thus shaped appears as carried in the carpenter's pocket in the old engraving of date about 1500 (Fig. 32), and also as the hand saw in Dürer's *Melancholia*, and in the *Annunciation*, *c.* 1438, by the unknown Flemish painter called the "Master" of Flemalle in the Merode Gallery, Brussels.

The compass saw (lower specimen), No. 6385, also with thin back and unset teeth, called "fret saw" and "lock saw" by Knight (*cf. American Mechanical Dictionary*, 1878), differs from the above in its modelled block handle grasp also riveted upon the blade; otherwise, it is only a large variety of the keyhole saw.

Fig. 132.—The Tenon Saw

The short, rectangular blade of this fine-toothed instrument, briefly described, but not illustrated, by Moxon, in 1678, and named, in the *New English Dictionary*, first for 1549, is so thin that to keep it from buckling, it is stiffened with a metal rib along its top. Hence, the blade never entirely penetrates the wood. With its slightly set teeth (8 to the inch in 1878, according to Knight) it was used one hundred years ago, as now, to smooth-cut the edges of tenons, dovetails, or mitre fittings, sawed in the mitre box. Open hand saws, stiffened with metal back ribs, are used in Japan (*cf.* Fig. 133), and a small form of similar instrument, with hollow-grasp handle, and stiffened with a wooden back rib, as an extension of its handle, is shown in Fig. 134, as used by cabinetmakers in China.

Modern varieties, with metal back ribs, are described by Knight as the "Dovetail Saw," for cutting dovetails, with 15 teeth to the inch and about 9 inches long (also illustrated with a straight handle in Disston's *Saw in History*), the "Carcass Saw," with 11 teeth to the inch, and the "Sash Saw," backed with brass instead of iron, with 13 teeth to the inch.

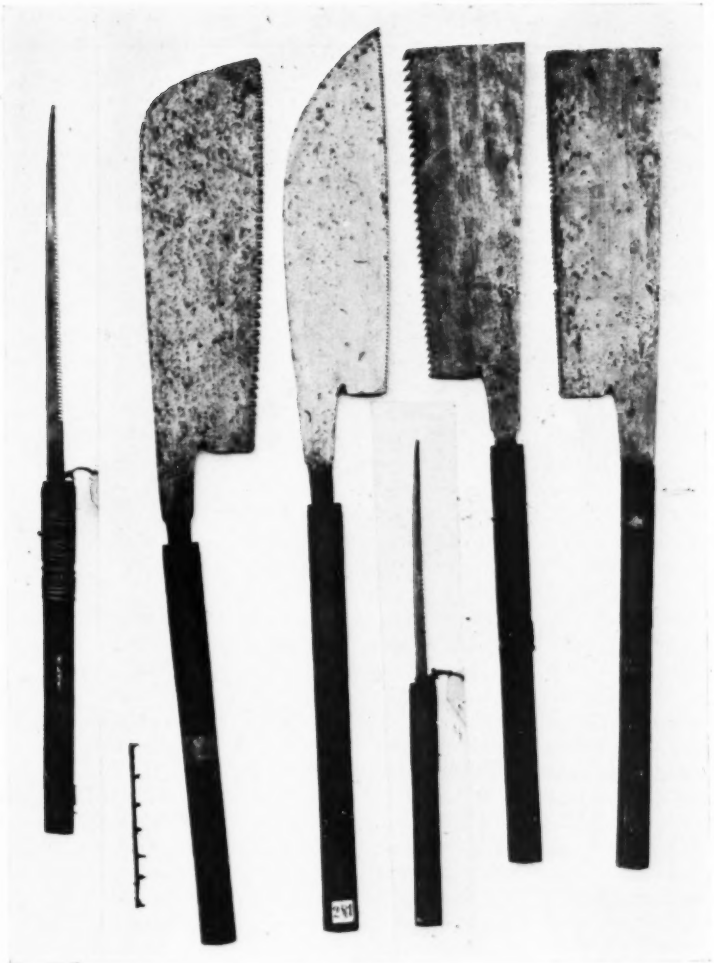


Fig. 133.—Japanese Hand Saws

These saws were collected in Japan, before 1873, and were exhibited in the Vienna World's Fair of that year. They are now (1926) in the Commercial Museum of Philadelphia, and were photographed by kind permission of the Director, Dr. William P. Wilson.

Though ignorant of the history of Japanese saws, we learn from a Japanese sawyer, now working at Kuling, China, questioned by Mr. R. P. Hommel, in 1925, that specimen No. 2, counting to right with very long, paired, and slightly raked teeth, is used for cross-cutting; No. 5, with large, sharply raked teeth, diminishing in size towards the handle, is used for ripping, that other varieties, not shown, stiffened by back ribs, are used as tenon saws. Some Japanese saws are double, *i.e.*, toothed on both sides of the blade, and a large variety of No. 5 is used for tree felling, by sawing off cleared roots and then roping the tree top and pulling over the trunk to break the tap root. All these saws cut on the pull of the workman, and all are tanged upon straight wooden handles wrapped with bamboo. Nos. 1 and 4, counting to right which are keyhole saws, are con-

example illustrated by Moxon (Fig. 67E). The lower saw, probably much reduced by sharpening, also shows the slotted block handle with open grasp riveted upon the blade, still in use.

Look next at another ancient variety of the one-man, open hand instrument, namely

The Tenon Saw (Fig. 132)

Here the extra-thin, fine-toothed rectangular blade with hollow-grasp handle slotted and riveted upon it, intended for very exact mitring or otherwise cross-cutting of comparatively small flat wooden strips, is stiffened to prevent buckling or wavering, by a steel rib upon its back margin. Therefore the entire blade can never penetrate a piece of wood.

Moxon illustrates a variety of the mitre box (Fig. 78) in which these back-ribbed hand saws have been continually used since his time; but though he imperfectly describes, he unfortunately does not illustrate the saw itself. Nevertheless, as here shown, it is clearly pictured in the *Circle of Mechanical Arts*, of 1813.

From a world-wide and historical point of view, the comparatively short, open, one-man hand saws, in their three ancient types, as thus described, form a distinct class by themselves, while their varieties in size, handle and blade construction, adapted to several purposes of fine or coarse or straight or curved cutting, seem minor considerations, compared to the two following facts, in their construction, namely: first, that as distinct from some of the preparatory saws (pit saws), already described, none of their blades are strained upon a frame, but all cut with the open blade; while, as here shown, in their American and Continental European types, they are all extra strong, or wide or stiff, to prevent buckling; and second, that all are equipped with teeth raking away from the workman, and hence, as described later, designed to cut on the push, while the Chinese and Japanese open hand saws, and (as Disston asserts) the Turkish hand saws, tooth-raked contrariwise, cut on the pull.

Supplementing Disston's interesting illustrations (*cf.* his valuable pamphlet *The Saw in History*, Henry Disston & Sons, Phila., 1916) we, by help of photographs from originals, here illustrate several

Japanese Hand Saws (Fig. 133)

thus pulled by the workman, originally collected in Japan for the Vienna World's Fair of 1873, and kindly loaned for illustration by the Commercial Museum of Philadelphia.

In comparing these beautiful and delicate pull saws made of finely wrought steel, with our own old push saws, we find that though less effectively grasped, in their straight handles wrapped with bamboo, their teeth, in one case diminishing in size towards the handle, are far more varied, elaborate, and effective, than those of our

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structed like ours, with unset teeth and blades thickened on the toothed edge to widen the kerf. Otherwise, the teeth of all of them are not only carefully sharpened, but set, *i.e.*, bent to the right and left to prevent blade friction by enlarging the kerf.

Owing to their straight handles they are less firmly grasped than our saws, but they cut, according to Mr. Hommel, more easily. Their far more delicate and varied teeth require much greater care and skill in sharpening with very fine, knife-edged files.

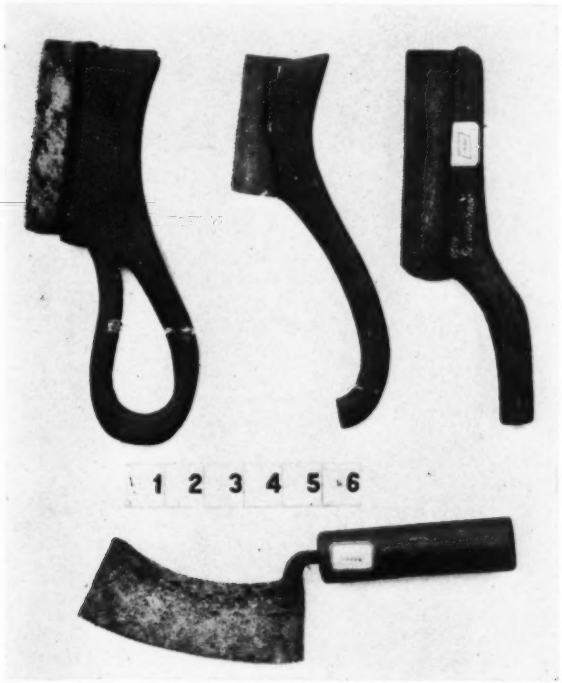

Fig. 134.—Chinese Cabinet- and Coffinmakers' Saws

Photographed by kind permission of the Commercial Museum of Philadelphia, from specimens in their collection. According to information received in 1925 from Mr. R. P. Hommel, at Kuling, China, the three little upper saws, in which the blade is stiffened by inserting it in a slot in the wooden handle, are used by cabinetmakers for sawing tenons or dovetails, or channels for the insertion of key-blocks (described later) in furniture. The lower saw, without this back stiffening, mounted on a tang, is employed by all coffinmakers in sawing the grooves for the insertion of the end panels in the remarkable Chinese coffins, the four long sides of which consist of four log-slabs thus boxed together at either end. Though the tooth-rake of these little open hand saws does not show clearly in the photo-engraving, they all cut on the pull, according to Mr. Hommel. Hollow hand grasps, as on the upper left-hand specimen, appear sometimes, but not always on these Chinese cabinetmakers' saws.

A modern factory-made variety of the three upper saws, *i.e.*, in which the blade is slotted into an extension of the wooden handle called the "stair builders' saw", appears in recent price lists, and is illustrated in Disston's *The Saw in History*.

Disston also shows two small, fine-toothed, modern forms of the lower specimen, minus back stiffening, with blades riveted upon open wooden hand grasps, called the "pattern-maker's saw," and the "joiner's saw."

pre-factory instruments of one hundred years ago, and therefore must have required much greater care and skill in sharpening, with far finer knife-edged files, than ours. As related to these, the next picture shows several.

Chinese Cabinetmakers' and Coffinmakers' Saws (Fig. 134)

which also, as one-man, open hand saws, generally contradict our saws in action and, like the Japanese speci-

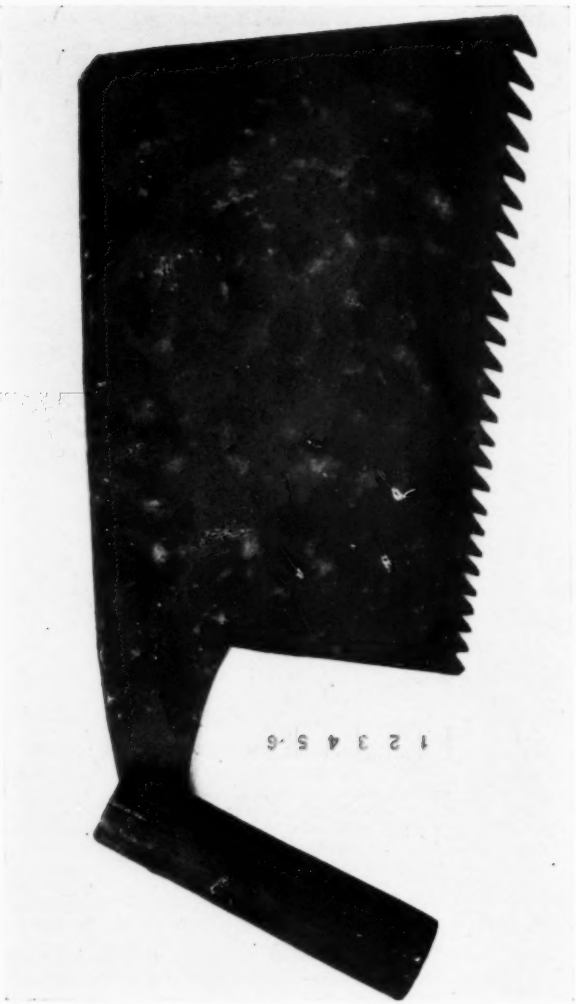

Fig. 135.—Japanese Rip Saw or Board Saw

In this remarkable one-man rip saw, with blade 21 inches long tanged into its wooden handle, the teeth are raked to cut on the pull as in the smaller hand saw shown in Fig. 133 and decrease in size towards the workman, according to Disston, *The Saw in History*, p. 10, which shows a picture of the saw in use. The single Japanese workman, standing upon a small log, propped up at one end on a large log, cuts the former longitudinally into one or more planks or strips with this saw. Photographed by kind permission of Dr. W. P. Wilson, Director of the Commercial Museum, Philadelphia. The specimen there on exhibition had been shown at the Paris Exposition in 1900. With teeth apparently never sharpened or set, it seems never to have been used.

mens, cut on the pull; while the cumbrous

Japanese Rip Saw or Board Saw (Fig. 135)

illustrates the remarkable instrument, not used in China, by which a single Japanese workman, standing on a tilted log, saws it into boards.

Though in general the bronze or iron or steel saws of pre-historic times, or of Greece, Rome, or Egypt, however constructed have long since rusted, or lost their mounting, a few ancient and very rare specimens of this open-unframed type, much overlooked by antiquaries, have been preserved in Museums, such as the

Egyptian Hand Saw (Fig. 136)

found by Mr. James Burton, in a basket of carpenter's tools in an ancient tomb of the 18th Dynasty (*c.* 1450 B.C.) at Thebes, and here illustrated by the kind permission of the British Museum.

A celebrated wall picture from Thebes, showing a man ripping downwards a vertically set board with one of these open saws, but much longer than the specimen here shown, published in Wilkinson's *Ancient Egyptians*, John Murray, London, 1854, p. 118; several moulds for casting bronze saws, found in Scandinavia, and illustrated by Disston; saw blade fragments found in Assyria, or at pre-historic Swiss lake dwellings, shown in

Fig. 136.—Egyptian Hand Saw

This saw, now in the British Museum, was found in 1853, in a dry and dusty tomb of the 18th Dynasty, or about 1450 B.C., at Thebes, by Mr. James Burton. It was in a basket, along with drills, a drill bow, chisels, an oil horn, a nail bag, and a short wooden club mallet, swelling at one end into a heavy conical cylinder, shaped like the modern sculptor's mallet, but made, not with an extra wooden handle inserted in a bored hole, but of a single stick, like the frow club shown in Fig. 13. The saw-blade is of bronze or hardened copper, mounted on a tang, in a handle of wood. The teeth are not set, and are V-shaped, without rake. Hence the instrument would cut both ways. Its blade is 10½ inches, and its handle 4⅝ inches long. Photographed by kind permission of the British Museum.

outline or photograph by Sir W. M. Flinders-Petrie in *Tools and Weapons*, Constable, London, 1917; conclusively prove that these short one-man, open blades, as distinct from framed saws, were in use from the beginning of history. Hence, we may reasonably infer that they continued in use in various shapes and forms throughout the Middle Ages. But in an effort to trace them backwards from Moxon's time, books and pictures fail us. As filling the historic gap of two thousand years, we have been unable to here illustrate anything older or more interesting than the little tanged instruments, of compass saw shape, in Dürer's *Melancholia* (Fig. 107), or in the pockets of carpenters in the German print shown in Fig. 32, or finally the large, sword-like specimen

AN ITALIAN HAND SAW OF THE 17TH CENTURY (Fig. 137)

here reproduced from an unidentified Italian print probably engraved before 1700.

So much for the open, one-man hand saw, but as a little reflection tells us not only that a saw blade, if thin and narrow, will cut better than if thick and wide, but also that a thin and narrow blade will buckle or bend, even if made of steel, unless it is either pulled toward the workman, or strained upon a frame, we find, as we might expect, that a considerable variety of thin-bladed saws, mounted in frames, were used either by one or two men for various woodworking purposes a hundred years ago. One of the most familiar of these was and still is

THE WOOD CUTTER'S SAW OR BUCK SAW (Fig. 138)

Let us look closely at this ancient framed saw and in order to escape the confusion that has followed the history of saws in general, observe clearly, first, that the thin, flexible blade is strained, not in the middle, but along the margin of its frame, by means of a rope twisted tight between its side arms, upon a stick caught against its central brace, and second, above all, that its blade is rigid. It is this latter important fact which greatly limits the use and scope of the instrument. You cannot rip, *i.e.*, cut longitudinally, a board, nor cross-cut a large log, with the buck saw, because the central brace is continually in the way. Hence, the buck saw is, and always has been, confined to the cross-cutting of comparatively thin or narrow wooden pieces. Although frequently shown by Diderot, as used by French carpenters and woodworkers in the 18th century, the old Anglo-American carpenter seems to have rejected it. As here illustrated, in a homemade frame, it is still used, not by carpenters and joiners, but by farmers, when holding the long frame-side of the saw, left hand uppermost, and right hand on its lower extension, they cross-cut fire wood sticks on

THE SAW BUCK OR WOOD HORSE (Fig. 139)

another still familiar apparatus described by Moxon, consisting of two wooden crotches, pegged together on a cross bar.

Having noticed the rigid blade of the wood saw, let us look carefully at the next saw, here illustrated, superficially resembling it, often confused with it, but which, by a slight difference in construction, far outclasses it in efficiency. This is

THE BOW SAW (Fig. 140)

Fig. 137.—Italian Hand Saw of the 17th Century

From an unidentified copper engraving, in the Italian style of the 17th century, representing *The Downfall of Paganism*, in which St. Simon is shown (as usual by the Old Masters) with a saw,—this time a large, long-bladed open hand saw, in his left hand, as he reads a book.

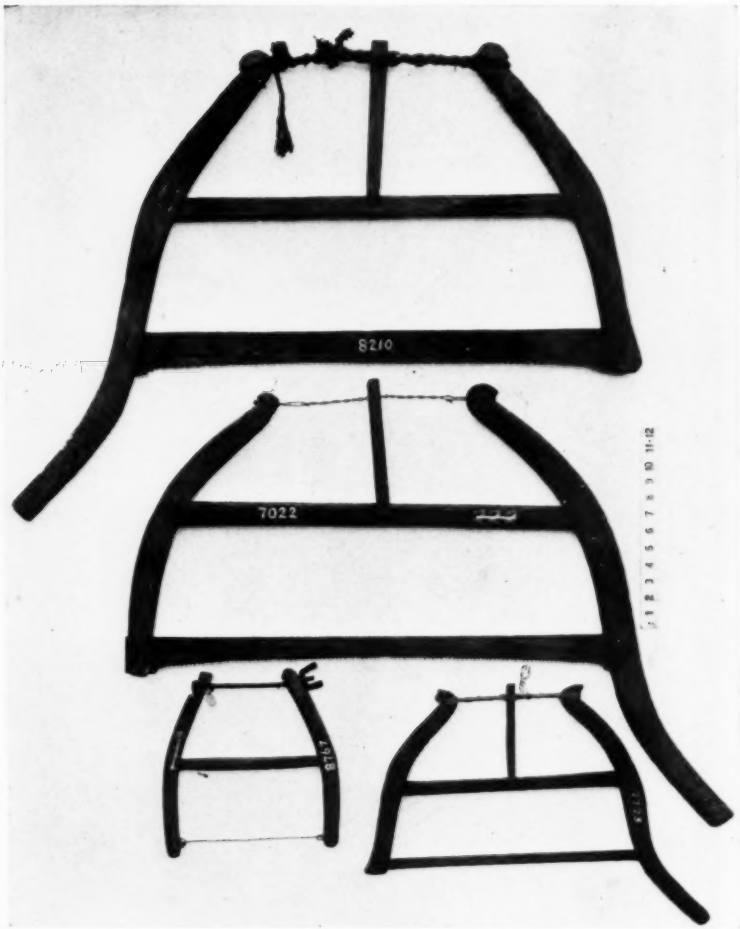

Fig. 138.—The Wood Cutter's Saw or Buck Saw

This saw of ancient European type, in construction, resembles Fig. 140, except that the blade is wider and therefore stronger, and not adjustable to various angles, but rigid. Now (1926), it is still widely used among farmers, etc., who grease the blade with a piece of hog fat, kept hung on a nail in the wood shed, and cross-cut firewood sticks laid on the wood horse (Fig. 139). The specimens shown are from Bucks County, with blades probably factory made, but in frames constructed by the farmer or village carpenter or wheelwright.

Out of place here, the small saw, No. 8767, tightened with a thumb screw, bought from C. E. Osburn, Philadelphia, in October, 1907, was used for cutting cheese.

The writer has been unable to learn whether this device of the rope-twist and twist-stick, was known in ancient Rome or Egypt. W. M. Flinders-Petrie, in the series of classified groups of outline drawings and photo engravings of ancient implements, now exhibited in European museums, in his *Tools and Weapons*,

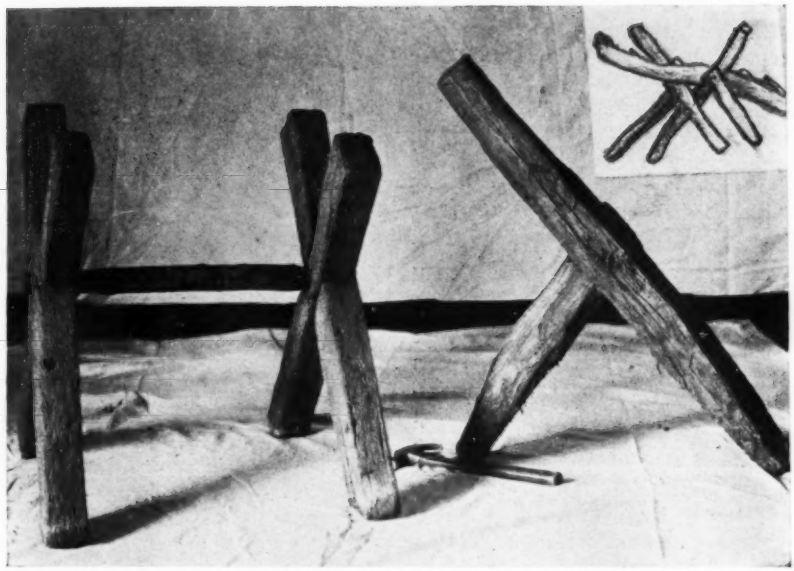

Fig. 139.—The Saw Buck or Wood Horse

As represented by Moxon in 1698, each end of the apparatus (left) consists of two heavy wooden sticks mortised together in the form of a diagonal cross. These crosses are pegged together in the middle on a stout longitudinal stick, so as to form a double crotch, upon which the farmer, having placed the long firewood stick, whereon he rests his left knee, saws off the stick inside or outside the crotch, with the buck saw. This specimen, fifty or more years old, now owned and loaned for the picture, by Mr. B. H. Barnes, was used by his father and grandfather on a farm about a mile and a half north of Doylestown, Pa.

The *New English Dictionary*, quoting 1860 for its earliest use of the American name "saw buck," derives it from the Dutch Zaag-boc, and German Saegebock,—Zaag, Saege=saw, and boc, bok=goat. In New England it is known as a "saw horse," in the vernacular of the 19th century.

The right specimen is one of a curious class of tree sawyer's props, used in pairs, and pushed close together from opposite sides under the uplifted heavy bough of a freshly felled tree, as shown in the appended outline, whereupon the bough is sawed off with the buck saw or cross-cut saw. Bought from William Giles, on Buckingham Mountain, Bucks Co., Pa., in 1926.

Constable, London, 1910, shows an old Egyptian frame saw "from the Fayum," as if it might be the only ancient frame saw thus far found in its original frame. But it is stretched on a bent staff, lacks the rope and twist stick, and is therefore constructed, not like the buck saw, here described, or the bow saw, but like the Buhl saw, Fig. 144.

One of these instruments, thus tightened with the twist-stick and with the long handle-extension on one side of the frame, though not clearly showing whether its *blade* is twistable or rigid, appears in a French manuscript miniature of the middle 15th century, *Valeur Maxime*, by Simon de Hesledin et Nicholas de Coiresse (British Museum, Harl. 4375, fol. 123, *cf.* also *The Guilds of Florence* by Edgecumbe Staley, Methuen, London, 1906), kindly shown the writer by Mr. Joseph E. Sandford, and a photograph recently received from Mr. R. P. Hommel proves that an exactly similar saw, with rigid blade, though lacking the long handle-extension, is now (1926) in general use among the carpenters of China.

otherwise called by Holtzapffel, in 1846, "Continental Frame Saw;" by Knight, in 1878, "Turning Saw," "Sweep Saw," "Frame Saw;" and by Disston, in 1916, "Web Saw;" which, as the great rival of the open, hand saw described (Fig. 129) and preferred thereto in some parts of the world, may be considered as one of the most interesting and important tools of the ancient carpenter.

In this one-man instrument, the blade is again strained, not in the middle of a frame, but along its margin by means of a rope twisted tight between its side arms with a stick caught against its centre brace or frame-fulcrum, so as to pry open the side arms upon the saw blade, and which brace, in all the old homemade specimens here shown, is loose and shiftable, in its end mortises, like the Korean pit saw (Fig. 25). But its great superiority lies in the fact that its blade is no longer rigid, but adjustable. That is, it can be turned by means of projecting handles, so as to cut not only on the plane of the frame, but at any other desired angle. Hence, within the range of its frame construction, it will cross-cut a board, or "rip" it longitudinally, cut straight, or, if thin enough, cut at a curve, when sometimes the blade, releasable at one end, could be inserted or withdrawn through a previously bored start hole. The instrument unmistakably drawn with its twisted rope, twist stick, and blade handles, appears among the old woodcuts as one of the letters of a pictorial alphabet in the *Oratoriae Artis Epitomata*, of the Florentine Jacopo Publicio, published by Erhard Ratdolt at Venice in 1482-1485, kindly shown the writer by Mr. Joseph E. Sandford. Two hundred years later, in 1678, Moxon describes and pictures this master saw (*cf.* Fig. 67) and Holtzapffel, in his unique and indispensable description of saws in *Turning and Mechanical Manipulations*, illustrates and carefully describes it as used in England in 1846. But the evidence indicates, that though employed, as he says, for special and curvilinear cutting, it was never popular with the Anglo-American carpenter in the 17th and 18th centuries, or used by him as a substitute for the common, open, unframed hand saw. Not so, however, in France, where Diderot, in 1768, illustrates an example of it, rather than the open-hand saw, under discussion, as one of the typical bench instruments of the French carpenter and joiner.

In spite of its awkward shape and the fact that the frame is often in the way, we learn from Disston, Mr. R. P. Hommel, and personal observation in museums, that in Germany, Switzerland, Austria and Eastern and Northern Europe, the open hand saw has never rivalled or superseded it among carpenters, as the favorite instrument of its class, while in Korea and China, (though not in Japan), for no one knows how long, an exactly similar instrument has entirely displaced the open hand saw, to prove which, the next illustration

THE CHINESE BOW SAW (Fig. 141)

shows the same saw, now (1926) preferred for one-man sawing by the carpenters of China. Here, the toggle stick, in familiar American style, as above noted, is twisted against the rigid centre brace through several strands of hemp rope, while the blade, with teeth raked all one way, pinned upon wooden pegs penetrating the side arms, can be turned to any desired angle by the workman.

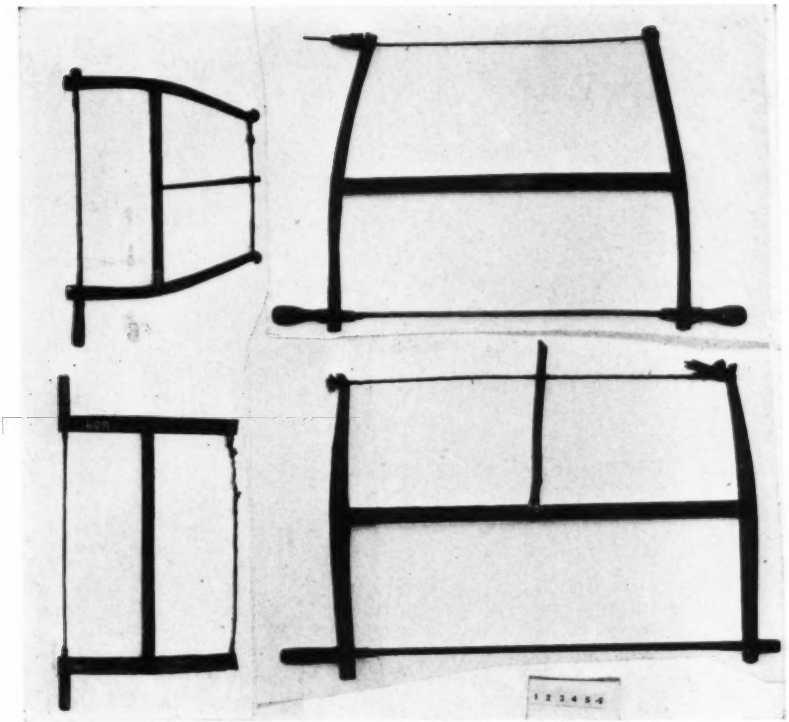

Fig. 140.—The Bow Saw

The very thin blades with their teeth slightly raked to cut one way, and which can be turned by means of the handles to any desired angle, are strained between the lower arm ends of the instrument, by twisting a stick through strands of cord connecting its upper arm ends, and then, to prevent back twist, catching the lower end of the stick upon the central brace.

In No. 18,848, a threaded wire, tightened with a screw instead of a cord, is used. The central brace, like that of the Chinese bow saw, Fig. 141, rests in a loose mortise. The handles (single in the upper left-hand specimen) end in round pegs penetrating the side arms, slotted inside the frame to receive the blade. Loose iron pins (not seen in the dark picture), penetrating the slots through end-holes in the blade, hold the blade in place, or release it, when said pins are easily driven out, after unstraining the instrument. In spite of its awkward shape, the carpenters of France and Germany, like the workmen of Korea and China, still prefer this instrument to the open, Anglo-American hand saw, and turn its blade at various angles to cross-cut and rip boards. The frames, if not the blades of these specimens, surviving among Pennsylvania-German cabinet-makers until about 1890, are homemade.

Gruter's little picture (*cf.* No. A, under Fig. 142), misrepresented as explained later, in many dictionaries, and the little outline drawings in Flinders-Petrie's *Tools and Weapons*, copied from Roman stone carvings, certainly represent frame saws with a central brace and blades strained on their outer margin, but none except Montfaucon show the twist stick, and none represent any sign of the handles for turning the blade. The little blade fragments with rivet holes, shown in *Tools and Weapons*, might belong to any kind of frame saw. In his brief references to museum specimens of ancient frame saws, Flinders-Petrie fails to note the difference, owing to this adjustability of the blade, between the buck saw and the bow saw, and we are left to wonder how long the Chinese have used the bow saw, whether they invented it or copied it from western nations, and whether the Roman or Egyptian carpenters could have ripped boards, with its shifting blade, twenty centuries ago.

Fig. 141.—Chinese Bow Saw

This instrument now at the Commercial Museum in Philadelphia, and photographed by the kind per-

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Knight, *American Mechanical Dictionary*, edition 1878, calls it the bow saw, also the "turning saw," "sweep saw," "frame saw," and "web saw." Disston, *The Saw in History*, 1916, prefers to name it only "web saw."

A bow saw very clearly shown with rope-twist, toggle-stick, and turn handles for the blade, appears in a woodcut alphabet of 1482, representing the letter E (by reason of the toggle stick) in an edition of the *Oratoriae Artis Epitomata* of Jacopo Publicio, published in 1482–5, at Venice, by the printer Erhard Ratdolt (*cf. Early Venetian Printing*, New York, Charles Scribner's Sons, 1895). Kindly found and drawn for the writer by Mr. Joseph E. Sandford, 1925.

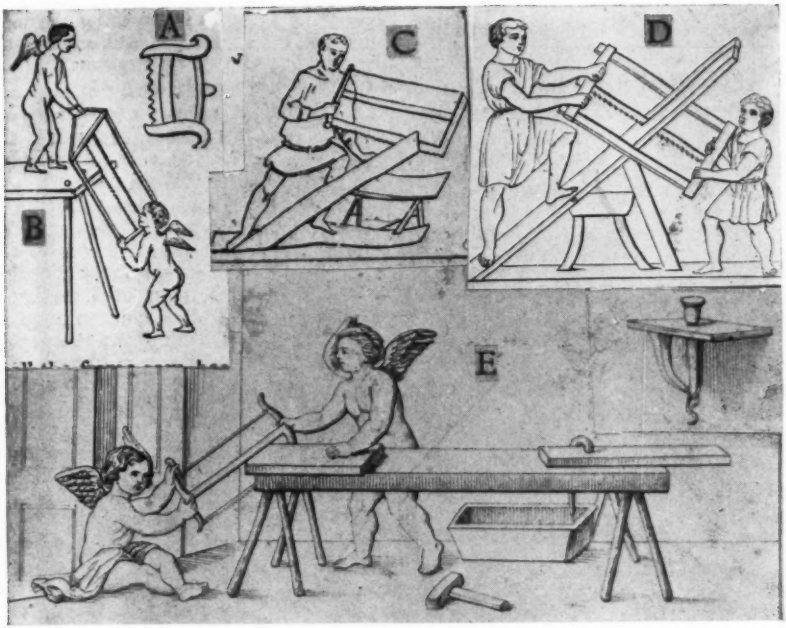

Fig. 142.—Ancient Frame Saws

The illustrations show — (A) An outline drawing of a frame saw with marginal blade, but lacking turn handles, rope and twist stick, from Smith's *Dictionary of Classical Antiquities* (Anthon's N.Y. edition, 1843) there acknowledged as "from a funereal monument published by Gruter." Knight's *American Mechanical Dictionary* copies Smith, in 1897, as does Disston in *The Saw in History*, in 1916. Rich shows the same saw, with ornamental cuts on the teeth, in 1843, as "from a sepulchral bas-relief", without mentioning Gruter or naming the bas-relief. Neuberger, *Technik des Altherthums*, Leipzig, 1919, copies Rich. A similar drawing, but clearly showing the twist stick, appears in a minute corner plate showing eleven "joyner's tools", labelled "Gruter", by Father Montfaucon, in the English translation of his *Monuments of Antiquity Explained in Sculptures*, 7 Vols., Tonson and Watts, London, 1722.

(B) Two genii ripping a board with a pit saw. According to Anthon's *Classical Dictionary*, article *Serra*, the picture is from a manuscript of Discorides of the 6th century, sometimes called the *Codex Cantacuzene*. Knight (*cf. American Mechanical Dictionary*) who confuses it with (E), here shown, says it was found at Herculaneum.

(C) A man ripping a board with a frame saw of questionable pattern without toggle stick or turn handles for the blade. From a painted glass vase from the Catacombs at Rome in the Vatican Library (*cf. Technik des Alterthums*, Neuberger, Leipzig, 1918, p. 77).

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mission of Dr. W. P. Wilson, was obtained in China and exhibited at the Vienna World's Fair of 1873. It represents the carpenter's one-man framed hand saw, not only of China, but of Korea, being constructed like two others now in the Bucks County Museum, bought from a Korean carpenter by the Rev. Clarence Hoffman, missionary at Kangsi, Korea, in 1923. With a stick twisted through several strands of hemp cord, and locked against the central brace, which latter is loosely mortised into the side arms, it is in construction an exact duplicate of the old Pennsylvania-German bow saws shown in Fig. 140. The marginal blade is fastened through holes therein, by loose iron pins pushed through the slotted inner ends of wooden pegs penetrating the side arms, and is set at any angle by turning the pegs, not by means of handles projecting therefrom outside this frame, as in the American saws, but by the inner ends of the pegs within the frame. The left peg, with widened inner end is released through an upward slot-extension of its peg hole, not seen.

Whatever the history or origin of this tool of the Far East, we learn from Mr. R. P. Hommel, that the instrument today (1926) replacing for all important Chinese purposes, the little open-hand pull saws shown in Fig. 134, cuts not on the pull but on the push, and from the Rev. Clarence Hoffman, that an exactly similar saw is now preferred and used by the carpenters of Korea.

Reasonable evidence shows that both the buck and the bow saw must have existed together throughout the Middle Ages, but they so closely resemble each other that it is difficult to distinguish them in old prints, while as we go back still farther, the confusion increases. The celebrated little engraving here marked A in the next illustration

Ancient Frame Saws (Fig. 142)

which has long figured in classical dictionaries to show that the Romans used the frame saw, has been so distorted and misdrawn, that it is almost as curious for what it does not, as for what it does prove.

It probably first appeared in *Inscriptiones Antiquae totius orbis romani* by the philologist Janus Gruter or Gruytere, Heidelberg, 1602-3 (2 vols.) 2d ed. with plates, Amsterdam, 1707 (4 vols.) The learned Father Montfaucon copies it with a twist stick, in a microscopic corner plate showing eleven "joyners tools," labeled "Gruter," in his *Monuments of Antiquity Explained in Sculptures*, English translation (7 vols.), J. Tonson and J. Watts, London, 1722. Smith's *Dictionary of Greek and Roman Antiquities*, edited by Charles Anthon, N. Y., 1843, there briefly acknowledges the same picture as "from a funereal monument, published by Gruter." Rich, above quoted, shows it again in 1849, "from a sepulchral bas-relief," whereabouts unnamed, without mentioning Gruter. Neuburger, 1919, copies Rich, without comment. Knight's *Mechanical Dictionary*, 1877, copies Smith-Anthon, and Disston, 1916, copies the latter or Knight. The little outline certainly does not represent a pit saw, for the blade is set on the frame margin. But is it a buck saw? Or is it a bow saw? Is the blade rigid so that it will only cross-cut, or adjustable, so that it will rip a board? Why does Montfaucon illustrate it with a twist stick, and Smith without one?

Fortunately, with the kind help of the Librarian of Congress, at Washing-

(D) Two young men ripping a plank with a pit saw, from a remarkable illustration to the word *Prisa*, in Rich's *Companion to the Latin Dictionary*, etc., London, 1843. Of the very important picture, Rich unfortunately says nothing more definite than that he has taken it "from a painted vase of early Etruscan or Roman make."

(E) The celebrated picture found painted on the walls of a house at Herculaneum, from the outline engraving in *Herculaneum and Pompeii*, by H. Roux Aine, ser. 10, plate 146, vol. III. By an open, panelled door, a genius seated on the floor holds with both hands a frame saw, as if in the act of sawing across the end of a short board laid flat on an eight-legged table. Another standing winged figure, holds the other end of the saw frame in its right hand. An unclawed hammer in the foreground, another board on the bench under a hook, a bowl on a shelf, and a box on the floor complete the picture. In this case, the saw blade, like that of the buck or bow saw is strained on the margin of the instrument. But as the cross brace rests on the board, with the blade far below it, the blade cuts nothing. Rich, above noted, escapes this error, by making a frame saw of the instrument, *i.e.*, he transforms the central brace, as here shown, into a notched saw blade. In any case, the saw here represented lacks the turn handles of the bow saw, and the twist stick of both it and the buck saw. Knight's *American Mechanical Dictionary* still further obscures the subject by confusing this picture with that from Discorides, here shown (B).

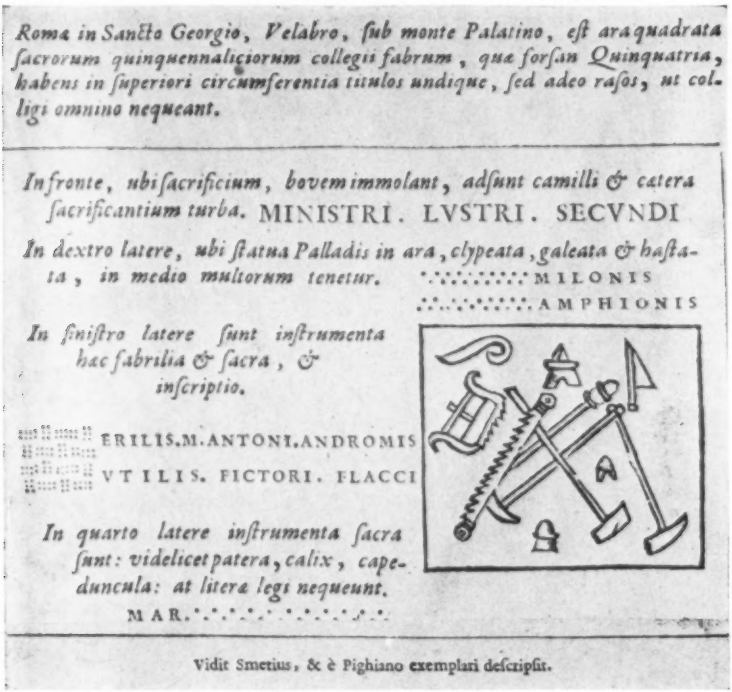

Roma in Sancto Georgio, Velabro, sub monte Palatino, est ara quadrata sacrorum quinquennaliciorum collegii fabrum, qua forsan Quinquatria, habens in superiori circumferentia titulos undique, sed adeo rasos, ut colligi omnino nequeant.
In fronte, ubi sacrificium, bovem immolant, adsunt camilli & catera sacrificantium turba. MINISTRI. LVSTRI. SECVNDI
In dextro latere, ubi statua Palladis in ara, clypeata, galeata & hastata, in medio multorum tenetur.
MILONIS
AMPHIONIS
In sinistro latere sunt instrumenta hac fabrilia & sacra, & inscriptio.
ERILIS.M.ANTONI.ANDROMIS
VTILIS. FICTORI. FLACCI
In quarto latere instrumenta sacra sunt: videlicet patera, calix, capeduncula: at litera legi nequeunt.
MAR.
Vidit Smetius, & è Pighiano exemplari descripsit.

Fig. 143.—Gruter's Roman Saw

As described in the text, this photo-engraving from a page of *Inscriptiones Antiquae totius orbis Romani*, by Janus Gruter, Heidelberg, 1602–3, 2 vols.; Amsterdam, 1707, 4 vols., shows, in a miniature group of eleven tools, briefly and only described by Gruter as "fabrilia et sacra", from the side of a Roman sacrificial altar on the Palatine Hill at Rome, the celebrated bow saw, under discussion, continually misrepresented in books and dictionaries. The toggle stick, here clearly represented, appears also in Montfaucon's copy, but is omitted in all the other versions of the saw seen by the writer.

ton, D. C., the writer has been able to show as a literary and historical curiosity

GRUTER'S ROMAN SAW (Fig. 143)

in a half-tone engraving copying the original page in Gruter, above noted, which is the starting point of these contradictions. The little group of instruments with Gruter's statement that it is taken from the left side of a rectangular sacrificial altar at St. Georgio, under the Palatine Hill at Rome, shows eleven tools which he refers to without describing, as "Instrumenta fabrilia et sacra," and there, in the upper right corner, the much misrepresented saw in question, appears with the toggle stick, which Montfaucon has copied correctly, but which all the other authors quoted have omitted.

Returning to Fig. 142 and the little pattern C shown from a painted glass vase from the Catacombs in the

Vatican Library, illustrated in *Technik des Alterthums* by Albert Neuberger, Leipzig, 1918, p. 77, which is certainly a one-man frame saw, a workman appears to be ripping a board laid end-up, on a stool, with what should therefore be a bow rather than a buck saw, though the instrument lacks the turn handles and twist stick. Another old picture B, described as from Herculaneum in Knight's *American Mechanical Dictionary*, but really from a miniature in the so-called *Codex Cantacuzene*, a manuscript of the Roman physician Discorides, written at the beginning of the 6th century (*cf.* Smith's *Dictionary of Greek and Roman Antiquities*, edited by Charles Anthon, New York, 1843, article SERRA) showing genii at work as wood sawyers, represents neither a bow or buck saw, but rather a pit saw, as previously described, because the blade is strained not on the edge, but in the middle of the frame.

Fig. 142 D, showing two men ripping a plank with a pit saw, illustrates the word *Prista* in the *Companion to the Latin Dictionary and Greek Lexicon*, by Anthony Rich, Jun. B.A., London, Longmans, 1849, in which Rich poorly describes it as painted upon a Roman or Etruscan vase, whereabouts unnamed.

Several ancient saw blade fragments, of bronze or iron, perforated with rivet holes, in various European museums might belong to any of the several kinds of frame saws, while in the most interesting pictorial relic of all, namely the dimmed fresco, found at Herculaneum (Fig. 142, E) the published engravings contradict each other, as when Rich pictures the blade set in the middle, and Barre (*cf.* H. Roux Aine and M. L. Barre, *Herculaneum and Pompeii*, Paris, Firmin Didot, 1870, plate 146) as here shown, on the edge of the frame, as if the instrument were sawing air.

A very much smaller and differently constructed one-man hand saw, with strained marginal blade, hardly thicker than a wire, was known one hundred and fifty years ago as

THE BUHL SAW (Fig. 144)

named from Boule, an Italian inlayer of brass and tortoise shell, who worked in France in the time of Louis XIV. As we have failed to find an old specimen, we here show one of the modern factory-made varieties, constructed in exactly the same way, which still survive for special wooden scroll or fretwork among cabinetmakers, or as playthings for boys. They were generally superseded in the middle and late 19th century by foot-turned machines working vertically with strained saw blades, too modern to be described here. In its old wooden framed form, the instrument is shown in an outline drawing by Holtzapffel, as used continually in the late 18th century, not to make veneers, but to saw out "marquetry" patterns therefrom. The tightly strained blade, easily working at various curves, and screwed upon the ends of a wooden elbow from 12 to 20 inches deep, would saw in counterpart several duplicate silhouette patterns at once, from several slabs of veneer, pasted together for the purpose, and held in the quickly released chops of a treadle clamp, also shown by Holtzapffel, in outline. Then, the workman sitting astride this latter apparatus, held the saw in his right hand, and worked it horizontally at right angles to the veneer, but at various tilts, swaying the frame to turn corners, describe circles, etc., and so suit the marked pattern.

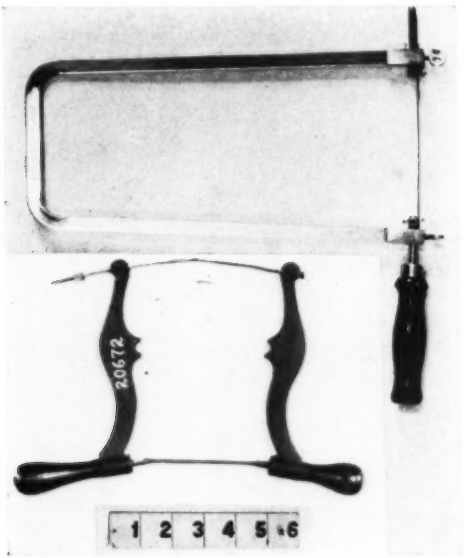


Fig. 144.—The Buhl Saw

As explained in the text, the upper specimen, now called "bracket saw" and "scroll saw" in a hardware price list of 1925, with its fine, adjustable blade fastened by thumb screws, is a modern, metal, factory-made counterpart of the wooden instrument as used in marquetry sawing, illustrated by Holtzapffel, *Turning and Mechanical Exercises*, vol. 2, p. 733. It is now employed by cabinetmakers for special scroll or fret work or wood inlaying. The smaller saw, constructed like a bow saw, with centre brace (lost), may have been used in a similar manner for small wood inlays in clock making. It was found among the tools used between 1820 and 1860, in the amateur workshop of C. J. Wister of Germantown.

William G. Thomson of 249 N. Hobart Street, Philadelphia, draughtsman, in Cramp's shipyard, and amateur wood-inlayer, informed the writer, May 30, 1926, that on inquiry among Philadelphia wood-inlayers, including an English workman, he had found none who had seen or heard of a wooden buhl saw, except a single Swedish inlayer who had used one, as described by Holtzapffel, in Sweden, about 1880. He also learned that in the early 19th century most of the wooden inlay work seen in the United States, and preceding such work produced here, had been imported from France, where it had been done in prison by convicts.

So much for the one-man frame saws and the varied work which one man could do, and in many parts of the world has done, for centuries, with this often preferred master tool, held in one or both hands, when its blade is strained upon the margin of the frame. But to conclude the subject of saw construction, it is necessary to examine two other interesting, generally larger, instruments — with blades fixed not on the margin, but in the middle of the frame, and one of which, generally too heavy for one man, had to be worked by two. This was

The Veneer Saw (Fig. 145)

The homemade examples of this now disused form of saw, in which the long flexible blade strained in the middle of the frame, by means of wedges or hand screws, cuts at right angles to the frame, looks like a pit saw and might easily be confused with the latter.

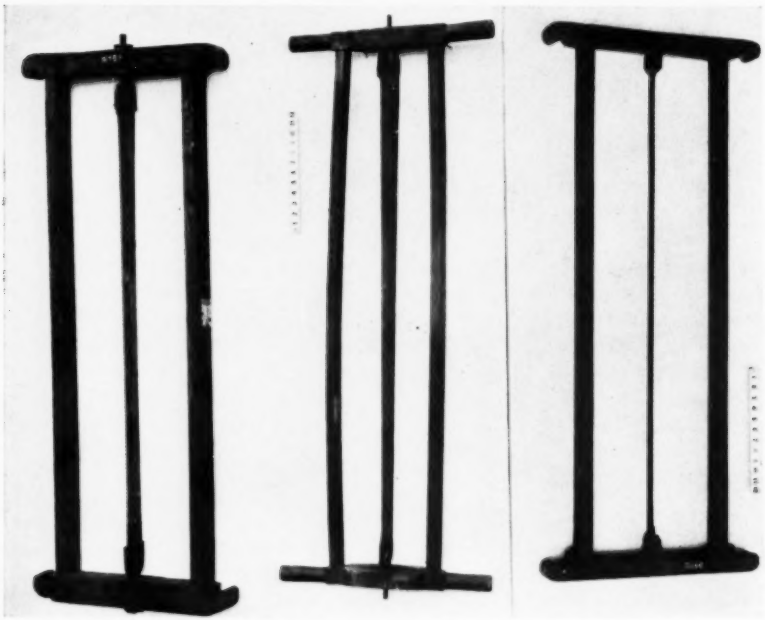


Fig. 145.—The Veneer Saw

In these long obsolete, interesting, two-man frame saws, the narrow, flexible steel blade is strained, not as in the buck and bow saws, on the margin, but in the middle of a rather heavy wooden frame, about 4½ feet long, and not by means of the familiar rope and toggle, but by corner wedges as in No. 8490 (right) or by tightly screwed bolts. The teeth, varying greatly in size in these and other specimens found by the writer, always much too fine for pit saws, are raked to cut one way, except in No. 16,989 (left) where they are raked both ways. Though light examples of this type of saw were, according to Holtzapffel, sometimes used vertically, by one man, for ripping boards and planks, they were commonly used horizontally, by two men, to saw veneers from balks of mahogany or to cut off boards about 6 to 8 feet long from quartered logs set vertically in a clamp or against the table in the workroom. (See Fig. 146.) This latter fact would account for the comparative heaviness of the frames, which in horizontal sawing would help, and not as in vertical sawing, exhaust the sawyer. No. 8490 (right) was used by a Moravian missionary and carpenter, about 1830 to 1840, among the Cherokee Indians in the Indian Territory to make door boards in log houses, and was brought back by him as a relic to Bethlehem, Pa., and descended to a carpenter in whose possession Mr. R. P. Hommel found and bought it in 1918.

A similar instrument, not shown, No. 17,474, was owned and used by Jacob Clewell, carpenter, of Nazareth, Pa. (born 1799, died 1871). From him it descended to his son, Christian Henry Clewell, undertaker of Nazareth (born 1826, died 1897), and from him to his son, Mr. Clewell, who sold it to Mr. Gieringer, who sold it to Mr. A. H. Rice, in December, 1920.

Nevertheless, the blades here shown, are too fine for board sawing from the log and they alone, as replacements, would not identify these old instruments. The frames also are too heavy for up and down pit work, and lack the extra protecting frame handles characteristic of the true pit saw, as described under Figs. 21 and 22.

In the hasty description of carpenter tools by Peter Nicholson in his *Mechanics Companion*, American Edi-

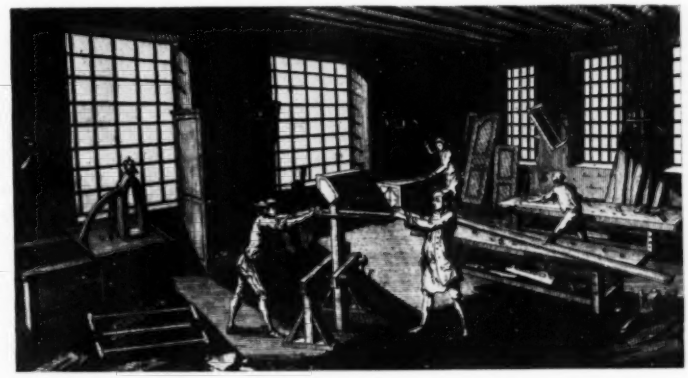


Fig. 146.—French Veneer Saws

This illustration from Diderot's *Encyclopedia*, of 1768, article *Ebeniste*, shows one of the veneer saws, shown in Fig. 145, on the floor, and another in use by two men.

Disston, *The Saw in History*, does not describe these ancient two-man framed saws, about 4 feet 6 inches long, in which the thin blade is strained upon and entirely encircled by a rectangular frame of varying width, resembling the framed pit saw (Figs. 21 and 22), but comparatively heavier and shorter and with much smaller teeth. Diderot, however, in 1768, illustrates and describes these now obsolete relics of the old woodworker, and according to information from Jacob Reptsik, cabinetmaker, of Lansdale, Pa., who used them at Gross Lomnitz, in Northern Hungary, in 1885, they were there employed by cabinetmakers to cut short boards, veneer strips, etc., from timbers, set up vertically in a frame, as appears in the above picture, or against the work bench where the two men, standing on either side of the timber, worked the saws, not up and down like the true pit saw, but horizontally, and where the comparatively extra weight of the frame would be helpful.

In some of the instruments the teeth are raked in opposite directions from the middle of the blade, so that each man would have to do half the cutting, while in others, with a single rake, one man does it all. For veneering, the instruments would slowly cut about twelve veneers to the inch, and for that purpose they must have gone rapidly out of use after about 1820–30, when, by help of the newly perfected steam power, the power-run circular veneer-saw (invented by Isambard M. Brunel, in 1805–8) cut fifteen to twenty veneers to the inch and made veneering cheap and popular. The latter fact is proved by the once common machine-made veneers glued upon mitred mirror frames, nailed together with post-1820 cut nails, which became fashionable about 1840 to 1860.

tion, Philadelphia, Lacken, 1832, this forgotten and obsolete instrument is not noticed, but fortunately Charles Holtzapffel clearly describes it as used by cabinetmakers, rather than pit sawyers, one hundred years ago. Then, two workmen held the saw, not vertically, but horizontally, to cut veneers, about six per inch, from balks set upright in a clamp. But the instrument would also cut out little boards in the same way and J. M. Reptsik, cabinetmaker, of Lansdale, Montgomery County, Pa., informed the writer in 1922, that he had seen similar saws used at Gross Lomnitz, in Northern Hungary, about 1880, by cabinetmakers, to cut special short boards used in furniture making, in which case the balk, sometimes penetrating the floor of the shop, was fastened vertically against the sides of the work bench or clamped in a frame. An illustration in Diderot's great *Encyclopaedia*, here reproduced as

THE FRENCH VENEER SAW (Fig. 146)

still further explains the instrument as in use in France, in 1768, by two parquetry makers (ebenists) who are

sawing veneers, as noted, not up and down, as with the pit saw, but horizontally from a balk set upright in a clamp.

As additional proof of the purposes and use of these two-man frame saws, which are not pit saws, we learn from the descendants of a cabinetmaker of Bethlehem, Pa., that one of the instruments now in the museum collection of the Bucks County (Pa.) Historical Society. No. 8490, had been taken *c.* 1830, by their ancestor, a Moravian missionary, to the Indian Territory, and there used by him to saw short boards to build log-cabin doors for the Cherokee Indians. On his return to Bethlehem he brought back the old saw as a relic of his pioneer life at a time when the unfortunate Cherokees had just been driven from their ancestral home across the Mississippi.

The Felloe Saw or Chairmaker's Saw (Fig. 147)

ends our list of saws, with still another of the now forgotten and almost obsolete handmade tools of the old woodworker. This shows a much lighter and generally one-man variety of the frame saw, which, by reason of its smaller size, unhandled frame, and much lighter teeth, is again not to be confused with the pit saws already described — Figs. 21 and 22. As the last of its class, it has survived until late in the 19th century, among wheelwrights, to cut felloes or segments of tires of wagon or wheelbarrow wheels from pieces of timber, wide enough for two felloes, held in a vise. Holtzapffel says that the same light instrument was used in 1846, in England, by chairmakers, for cutting straight or slightly curved pieces used in their work. We learn from old wheelwrights that the stuff was fixed at an upward slant or horizontally in the bench vise, or projected from the bench, and one workman, standing erect and grasping the saw by its side rails, sawed up and down, or at a down slant, with the teeth held away from him.

To classify and describe saws, as we have done, or even to see them in use, fails to get to the bottom of the subject, unless we answer two or three final but highly important general questions concerning the construction and history of this great master tool, usually overlooked in the books, but which any child might ask. First, that unless the slot or kerf cut by a saw is somewhat wider than the blade, the blade will stick or clog in the kerf. Hence, that either the kerf must be expanded with wedges, or the blade must be thinned above the teeth, as in the compass saw, or the teeth must be "set," that is, alternately bent to the right and left, as described later, so as to cut a kerf wider than the blade.

This difficulty of sawing in a kerf too narrow for the blade, which must have beset the saw from the beginning of its history hampers it still. To meet it, the old pit sawyer continually opened his kerf with wedges, and no one knows better than the modern tree sawyer, that when the fallen trunk or bough worked upon, sags upon the kerf, and squeezes the blade of his crosscut saw, he must either open the kerf with iron wedges, or stop work.

When, therefore, Flinders-Petrie (*cf. Tools and Weapons*, Constable, London 1910) says that the teeth of the earlier saws found in Egypt, were not set, we pause for a moment to wonder at what unrecorded moment in man's history, one of the most important of all tools, first became efficient by this process of

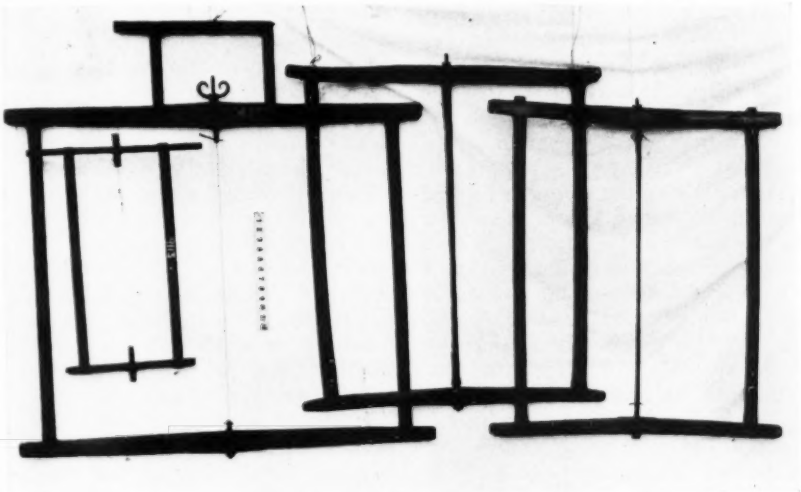


Fig. 147.— Felloe Saw or Chairmaker's Saw

These instruments are constructed like the veneer saws (Fig. 145), but are slightly shorter and comparatively wider. The adjustable blades and teeth found in them are much finer and adapted for curvilinear rather than straight cutting. Whether constructed for one or two men, they were used until about 1890, by wheelwrights for hand sawing the circular wood sections of the tires of wagon or wheelbarrow wheels, called felloes.

As with the veneer saws, it is easy to confuse large varieties of this felloe saw, particularly when equipped with extra frame handles, as in No. 4577 (left), with the pit saw already described, Figs. 21 and 22. But the veneer saw lacks projecting handles, and the felloe saw is too short, while the teeth of both, showing great variety in the specimens here shown, are never coarse enough for common pit-sawing of boards from the log.

setting its teeth, requiring a special set of instruments to be shown later? We are left to infer that the older Egyptian sawyers, when working with unset saws, must have continually greased their saw blades, and wedged the kerfs, in order to do any such otherwise impossible work as is vouched for in the celebrated picture published in Wilkinson's *Ancient Egyptians*, where we see represented in a sepulchral wall painting at Thebes, one man ripping a vertically clamped plank, with an open hand saw. But if the early Egyptians did not set their saws, there is no doubt according to the last named author that the Romans did set them, and we know that since their time saws have not only had to be set, as described later, but as now, continually reset, as the teeth bend back into their original position by use.

Hardly less important than the set of saw teeth is the fact that their generally triangular notches, by a process explained later, must be continually sharpened—that is sharp-pointed and sharp-edged, by application of a triangular or narrow file made for the purpose.

Besides this, the shape of saw teeth has always been of great importance in varying the thrust and power of the instrument. If the saw teeth are straight pointed, that is, with equal sides, they will cut both ways equally well. But if

raked, that is, with one side very nearly vertical, or shorter than the other, they will cut only on the short side. Hence, if the short side is faced towards the handle, the saw cuts on the pull, and if away from it, on the push of the workman.

What must also be a very important point in the ancient history of saws, is the fact that the blade of an open saw, unless extra thick or stiff, might bend or buckle if pushed to cut, but could not so bend if pulled. For which reason we might expect to find that the oldest specimens of these comparatively small and weak blades, as used by one man, with one hand, two thousand years ago, are constructed to cut on the pull and not on the push of the workman. On the other hand, this difficulty of blade buckling is obviated and the superior cutting power of a thin narrow blade attained, if the blade, no matter how thin or narrow and no matter which way worked, is strained upon a frame.

Hence, although ignorant of the teeth construction of ancient saws and without wishing to speculate too much on the interesting subject, we need not be surprised at the statement of Flinders-Petrie, who, though not clearly discriminating in this matter, between open and frame saws, says that the early Egyptian saws (before *c.* 666B.C. of bronze or hardened copper and thereafter of iron) all cut both ways with no tooth rake; that the first raked saw tooth appeared about 900 B.C., always upon open pull saws; and that there is no evidence of a push saw in Roman times.

But to return to our subject, namely the shape of the Anglo-American saw teeth under discussion, now so greatly diversified by factory patents, but here considered only in the ancient inherited outlines of one hundred and fifty years ago, we find that they are all raked to act as push saws, with one or two notable exceptions, namely, first, in the remarkable cross-cut saw, previously described (Fig. 31), where the elongated teeth, sometimes set in pairs and interspaced with wide open intervals, are not raked at all and therefore cut both ways. This is because the saw employed for heavy timber cutting is used horizontally, by two men, in which case each sawyer should do half the work. Another exception appears in the horizontal working, two-man veneer saws, just shown (Fig. 145), where, because both men ought again to cut equally, we find that in some cases, the teeth, as in the Korean pit or board saw (Fig. 25), are made to rake, half one way and half the other and therefore to cut both ways.

But who cared a century and a half ago how saws cut, or how, when and where they were made? What old dictionaries pretend to explain how the ancient blacksmith wrought, ground and polished the tool, or produced its teeth? What documentary evidence will show, except by random inference, that the undescribed process of hammering out long or broad saw blades, whether by water-run trip hammers, or by hand, had continued without change for centuries until about 1750, when the job was greatly facilitated by the general establishment in England, of heavy cylinders run by water, called rolling mills, to roll, rather than hammer out, thin sheets of iron or steel.

An inventory in the *Essex Co. (Mass.) Probate Records*, of the stock in trade of Edward Wharton, evidently a merchant, of Salem, Mass., shows that he had for sale in 1677 and 1678:

"3 whip saws and tillers, at 5 s. 6 d. a piece, and 15 hand saws of various sizes and prices," all of which must have been hand or trip-hammer-forged in England, either by general blacksmiths or special cutlers.

Advertisements in the *Boston News-Letter*, of May 15th and July 17th, 1760, kindly supplied to the writer by George Francis Dow, show that English imported hand and other saws, which must have been either hammered in the old water-run forges, or, by that time, rolled in the earliest rolling mills for the English cutleries, were sold in New England in Mary Johnson's shop in the Cornhill, Boston, and Edward Blanchard's shop in Union Street, Boston.

Bishop also shows that between the close of the American Revolution, *c.* 1785, and the start of the American factories, *c.* 1840, ready made saws or saw blades, were abundantly imported from Europe. Jeremiah Fern who made axes, near Doylestown, Pa., about 1865, says (1924) that he never made or heard of a blacksmith making saws. Nevertheless, as English saw factories were not probably started on a large scale until after 1750, and as English and European local blacksmiths had made saws for centuries before that, and as Karl Klemp, a German blacksmith in Doylestown, says (1924) that he hammered out the comparatively narrow blades of frame saws in Danzig, as late as 1890, it seems probable, though lacking positive proof, that American local blacksmiths sometimes made saws, as they made axes, in the 18th and early 19th centuries.

(To be continued)

Southern View of Deerfield, Mass.

PRINTED FROM THE ORIGINAL WOOD BLOCK, ENGRAVED IN 1838, FOR BARBER'S *Historical Collections*

Harrison Gray Otis House Built 1795

SHOWING THE HOUSE BEFORE THE WIDENING OF CAMBRIDGE STREET

The Otis House and Proposed Fireproof Museum

As the members of the Society know, the city of Boston decided some two years ago to widen Cambridge Street, the new street line to include not only the shops in front of the Otis house and the terrace behind them, but also the greater part of the front rooms of the house itself. This meant that the Otis house would be doomed to destruction unless the Society secured the two lots in the rear, numbered 10 and 12 Lynde Street, as a new site for the house, and these were accordingly bought with borrowed money.

The future of the Otis house being in this way safeguarded, the Board of Trustees next gave its attention to the imperative need for more museum space, as the Otis house had long since proved inadequate for the Society's constantly growing museum collections. In order to solve this problem the Board purchased, again with borrowed money, numbers 14 and 16 Lynde Street, being the two houses next beyond those it had just acquired.

The next problem was to finance moving the Otis house and remodeling and furnishing the new museum building. The city's award to the Society for the shops and land taken in widening Cambridge Street was $51,000, which was declined by the Trustees as

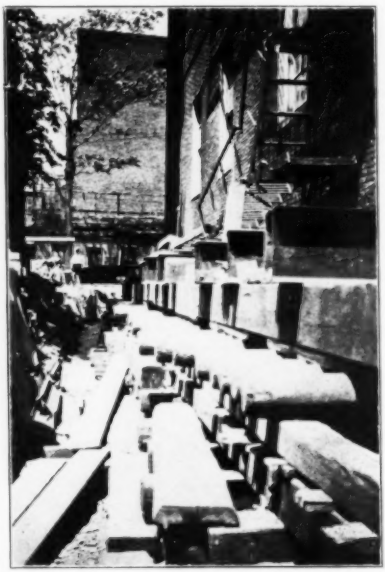
Harrison Gray Otis House Just Before Moving

being quite insufficient, and the postponement of any payment compelled still further borrowing. Additional sums were secured by two appeals to the Society's members in May, 1925 and May, 1926, resulting in gifts of $67,027.50, and with the cash from these appeals and loans, the Trustees were enabled to finance the work done to date. This may be summarized as the purchase of four Lynde Street houses and lots, the clearing of the site of two of them and moving thereto of the Otis house, and the construction of janitor's quarters, with all the large incidental expenses of new foundations and new heating plant, electric wiring, and plumbing.

The Society's officers are now able to forecast the remaining costs, which may be briefly summarized as follows:

Balance unpaid on bills incurred	$2,388.89
Secured loans	60,130.00
Unsecured loans	5,763.00
Converting 14-16 Lynde Street into a fire-resisting museum building	28,555.00
Furniture, fixtures, and dustproof museum cases, etc.	22,000.00
Restoration of Otis house (never completed)	5,389.00
Allowance for extras	5,000.00
Claims in dispute, under adjustment	2,023.88
	$131,249.77
Less credits	
Cash on hand August 31 $8,761.18	
City's award (minimum) 51,000.00	59,761.18
	$71,488.59

Moving the House



The House on Rollers

Towards securing this $71,500 the Society has a conditional offer of help. In the spring of 1925 one of our Trustees subscribed $5,000, with the promise to increase this to $10,000 if five additional gifts of the same amount could be secured. Three such gifts of $10,000 each have been found, but we still need two more in order to qualify for our Trustee's generous offer. ***It is these two gifts of $10,000 each that the Society most needs at the moment, and their receipt would practically insure the final success of our appeals. This conditional offer of $5,000 expires November 15.***

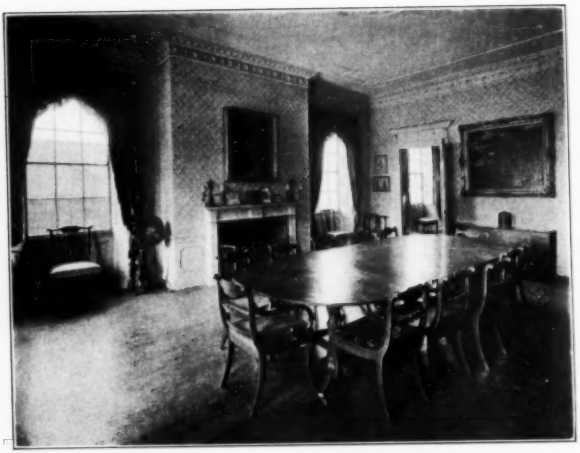
It is to be borne in mind that what the Trustees are now attempting is nothing less than to put the Society's New England Museum for the first time on a sound physical footing. The plan adopted involves transforming the two Lynde Street houses, numbered 14 and 16, into a museum building which will be practically fireproof. The remodelling of these houses, which will about double our space, will give the Society three floors in one and four in the other, available for the museum, the library and part at least of the offices. It is hoped then to furnish the Otis house in the style of its period, 1795, so making it an object lesson of value and beauty, an attraction well calculated to enhance the Society's reputation. The completion of these plans is wholly dependent on the success of the Society's financial programme, which aims to supply simply the physical needs of the museum plant.

Boston is now, as it always has been, the capital of New England. It is the

Pushing the House Backward from Cambridge Street by Means of Powerful Jacks

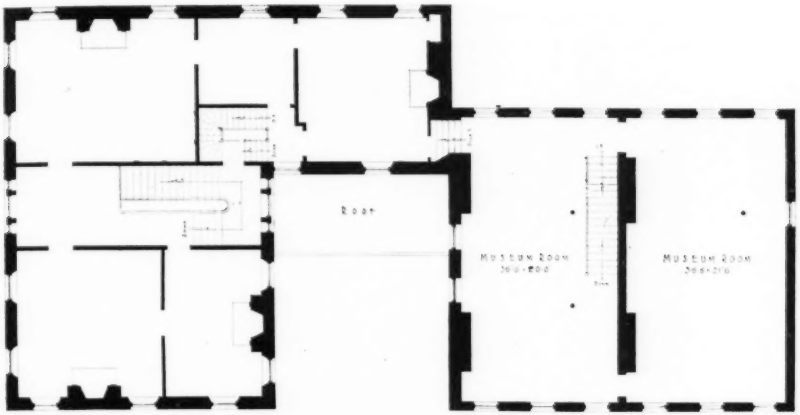
old chief town of the Puritans grown to metropolitan dimensions, but now, as then, the recognized center of New England affairs. It is the logical place for a New England Museum, and such an institution so placed should tend to grow rapidly in museum objects, equipment and wealth. It is to speed such a museum on its career that the proposed building and equipment are necessary, and New Englanders everywhere, and the members of the Society in particular, are urged to seize the present opportunity to do their share towards giving this ideal effect.

To sum up briefly, we still need $71,500. Towards this we have an offer, good until November 15, of $5,000 on condition two more gifts of $10,000 each are secured. As pointed out above, *our vital need of the moment is then two gifts of* $10,000 each, to be given or promised before November 15.



The Drawing Room, Otis House

Building the New Terrace in Front of the Otis House



Second Floor Plan of the Otis House

SHOWING THE CONNECTION WITH THE PROPOSED MUSEUM BUILDINGS IN THE REAR

The Harrison Gray Otis House

SHOWING THE HOUSE AS IT APPEARS SINCE ITS REMOVAL FROM THE OLD SITE

The Staircase Hall, Otis House

A Room in the Harrison Gray Otis House